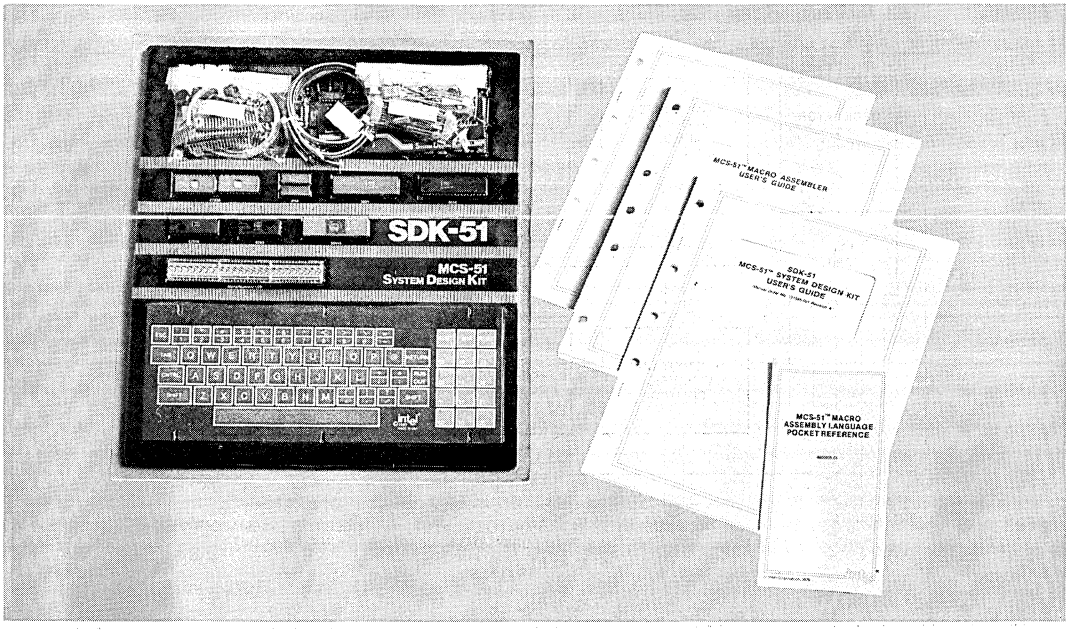
SDK-51
MCS-51 SYSTEM DESIGN KIT

- **Complete single-board microcomputer kit:**
  - **— Intel 8031 CPU**
  - **— ASCII keyboard and 24-character alpha-numeric display**
  - **— Wire-wrap area for custom circuitry**
  - **—User-configurable RAM**
  - **— Serial and parallel interfaces**
- **Extensive system software in ROM:**
  - **— Single-line assembler and disassembler**
  - **— System debugging commands**
    - **Go**
    - **Step**
    - **Breakpoints**
- **Interface software:**
  - **— Serial port**
  - **— Audio cassette**
  - **— Intellec® system**
- **User's guide, assembly manual, and MCS-51 design manuals**

The SDK-51 MCS-51 System Design Kit contains all of the components required to assemble a complete single-board microcomputer based on Intel's high-performance 8051 single-chip microcomputer. SDK-51 uses the external ROM version of the 8051 (8031). Once you have assembled the kit and supplied +5V power, you can enter programs in MCS-51 assembly language mnemonics, translate them into MCS-51 object code, and run them under control of the system monitor. The kit supports optional memory and interface configurations, including a serial terminal link, audio cassette storage, EPROM program memory, and Intellec® development system upload and download capability.



FUNCTIONAL DESCRIPTION

The SDK-51 is a kit which includes hardware and software components to assemble a complete MCS-51 family single-board microcomputer. Only common laboratory tools and test equipment are required to assemble the kit. Assembly generally requires 5 to 10 hours, depending on the experience of the user.

The MCS-51 Microcomputer Series

MCS-51 is a series of high-performance single-chip microcomputers for use in sophisticated real-time applications such as instrumentation, industrial control and intelligent computer peripherals. The 8031, 8051, and 8751 microcomputers belong to the 8051 family, which is the first family in the MCS-51 series.

In addition to their advanced features for control applications, MCS-51 family devices have a microprocessor bus and arithmetic capability such as hardware multipy and divide instructions, which make the SDK-51 a versatile stand-alone microcomputer board.

The 8031, 8051, and 8751 CPUs

The 8031, 8051, and 8751 CPUs each combine, on a single chip, a 128 x 8 data RAM; 32 input/output lines; two 16-bit timer/event counters; a five-source, two-level nested interrupt structure; a serial I/O port; and on-chip oscillator and clock circuits. An 8051 block diagram is shown in Figure 1.

The 8031, the SDK-51's CPU, is a CPU without on-chip program memory. The 8031 can address 64K bytes of external program memory in addition to 64K bytes of external data memory. For systems requiring extra capability, each member of the 8051 family can be expanded using standard memories and the byte-oriented MCS-80 and MCS-85 peripherals. The 8051 is an 8031 with the lower 4K bytes of program memory filled with on-chip mask-programmable ROM while the 8751 has 4K bytes of ultraviolet light-erasable, electrically programmable ROM (EPROM).

The 8031 CPU operates at a 12 MHz clock rate, resulting in 4 μs multiply and divide and other instructions of 1 μs and 2 μs.

For additional information on the 8051 family, see the 8051 User's Manual or MCS-51 Macroassembler User's Guide.

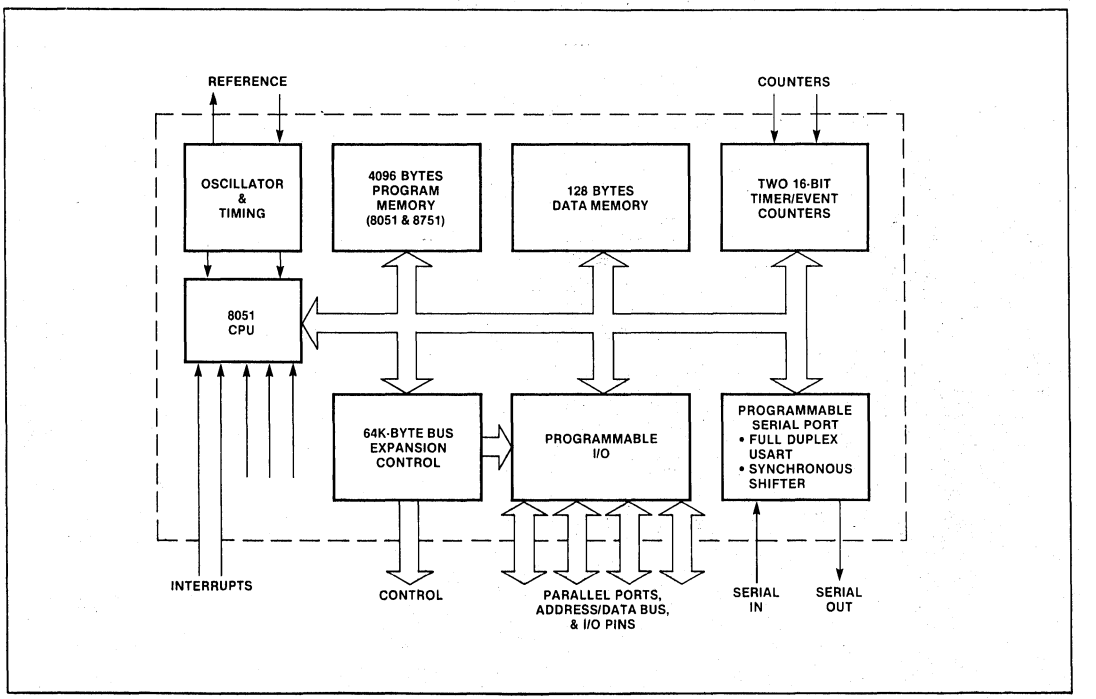


Figure 1. 8051 Block Diagram

System Software

A compact but powerful system monitor is contained in 8K bytes of pre-programmed ROM. The monitor includes system utilities such as command interpretation, user program debugging, and interface controls. Table 1 summarizes the SDK-51 monitor commands.

The ROM devices also include a single-line assembler and disassembler. The assembler lets you enter programs in MCS-51 assembly language mnemonics directly from the ASCII keyboard. The disassembler supports debugging by letting you look at MCS-51 instructions in mnemonic form during system interrogation.

Memory

The two 64K external memory spaces are combined into a single memory space which you can configure between program memory and data memory. The kit includes 1K-byte of static RAM. The board has space and printed circuitry for an additional 15K bytes of RAM and 8K bytes of ROM.

User Interface

The kit includes a typewriter-format, ASCII-subset keyboard and a 24-character, alpha-numeric LED

Table 1. SDK-51 Commands

Command	Operation
Set breakpoint	Define addresses for breaking execution.
Display cause	Ask the system why execution stopped.
Upload, download	Transfer files to and from Intellec® development system.
Save, load	Transfer files to and from optional cassette interface.
Set top of program memory	Define partition between program memory and data memory.
Set baud	Define baud rate value of serial port.
Display memory	Examine and change program memory or data locations.
Assemble	Translate an MCS-51 assembly mnemonic into object code.
Disassemble	Translate program memory into MCS-51 assembly language mnemonics.
Go	Start execution between a selected pair of addresses.
Step	Execute a specified number of instructions.

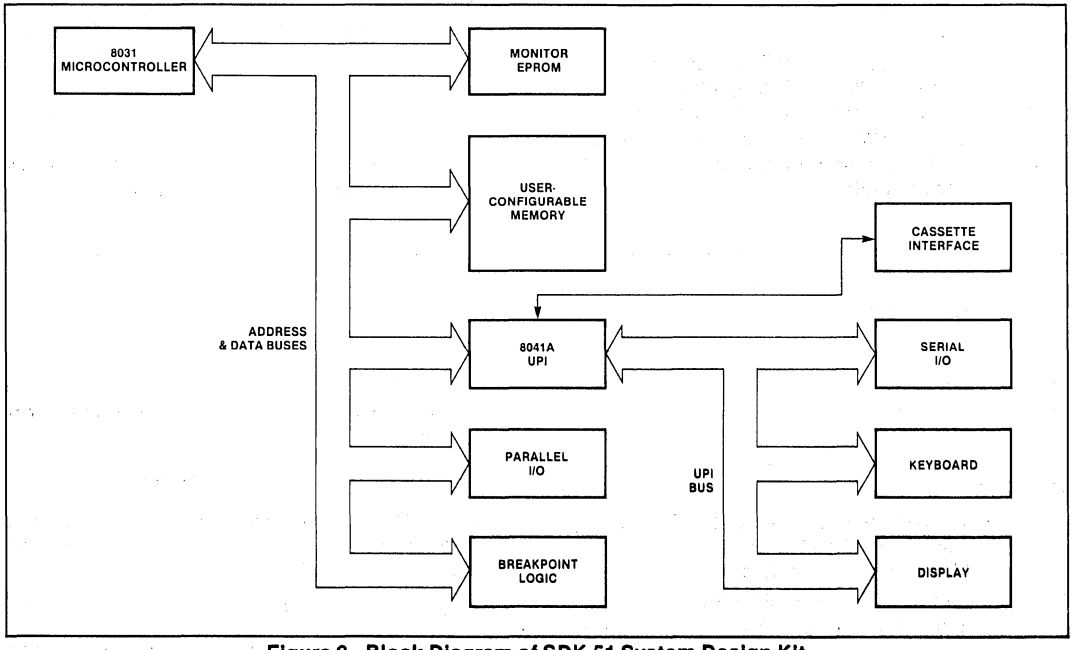


Figure 2. Block Diagram of SDK-51 System Design Kit

display. The standard keyboard and display provide full access to all of the SDK-51's capabilities. All of the SDK-51 interfaces are controlled by a pre-programmed Intel 8041 Universal Peripheral Interface.

A 3 x 4 matrix keyboard can be jumpered to port 1 of the 8031.

Optional Interfaces

TERMINAL

An RS-232-compatible CRT or printing terminal or a current-loop-interface terminal may be used as a listing device by connecting it to the board's serial interface connector and supplying + 12 and − 12 volts to the board.

AUDIO CASSETTE

The kit includes hardware, software, and user's guide instructions to connect and operate an audio cassette tape recorder for low-cost program and data storage.

INTELLEC SYTSTEM

An SDK-51 and an Intellec Model 800 or Series II development system with ISIS-II can upload and download files through the serial interface without adding any software to the Intellec system.

Parallel I/O

The kit includes an Intel 8155 parallel I/O device which expands the 8031 I/O capability by providing 22 dedicated parallel lines. Three 40-pin headers between the 8031 and 8155 devices and the wire-wrap area facilitate interconnections with the user's custom circuitry.

Debugging

Hardware breakpoint logic in the SDK-51 checks the address of a program or external data-memory access against values defined by the user and stops execution when it sees a "break" condition. After a breakpoint, you can examine and modify registers, memory locations, and other points in the system. A step command lets you execute instructions in a single-step mode.

Assembly and Test

The SDK-51 assembly manual describes hardware assembly in a step-by-step process that includes checking each hardware subsystem as it is installed. Building the system requires only a few common tools and standard laboratory instruments.

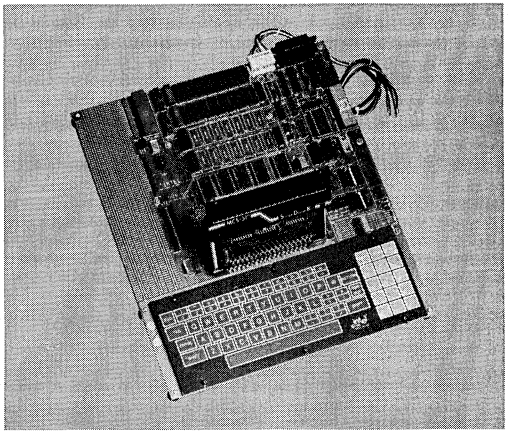


Figure 3. SDK-51 Assembled with Additional RAM and ROM Devices Installed

SPECIFICATIONS

Control Processor

Intel 8031 microcomputer
12 MHz clock rate

Memory

RAM — 1K-byte static, expandable in 1K segments to 16K-byte with 2114 RAM devices; user-configurable as program or data memory.

ROM — Printed circuitry for 8K bytes of program memory in 4K segments using 2732A EPROM devices.

Interfaces

Keyboard — 51-key, ASCII subset, typewriter format, 12-key (3 x 4) matrix

Display — 24-character, alpha-numeric

Serial — RS-232 with user-selectable baud rate. Printed circuitry for 110 baud 20 mA current loop interface. 8031 serial port.

Parallel — 22 lines, TTL compatible

Cassette — Audio cassette tape storage interface

Software

System monitor preprogrammed in on-board ROM

MCS-51 assembler and disassembler preprogrammed in on-board ROM

Interface control software preprogrammed in 8041's on-chip ROM

Assembly and Test Equipment Required

Needle-nose pliers

Small Phillips screwdriver

Small diagonal wire cutters

Soldering pencil, ≤30 watts, 1/16″ diameter tip

Rosin-core, 60-40 solder, 0.05″ diameter

Volt-Ohm-Milliammeter, 1 meg-ohm input impedance

Oscilloscope, 1 volt/division vertical sensitivity, 200 μs/division sweep rate, single trace, internal and external triggering

Physical Characteristics

Length — 13.5 in. (34.29 cm)
Width — 12 in. (30.48 cm)
Height — 4 in. (10.16 cm)
Weight — 3 lb (1.36 kg)

Electrical Characteristics

DC Power Requirement (supplied by user, cable included with kit)

Voltage	Current
+ 5V ±5%	3A
+12V ±5%*	100 mA
−12V ±5%*	100 mA

* ± 12 volts required only for operation with serial interface.

Environmental Characteristics

Operating Temperature — 0 to 40°C

Relative Humidity — 10% to 90%, non-condensing

Reference Manuals

SDK-51 User's Manual

SDK-51 Assembly Manual

SDK-51 Monitor Listing

MCS-51 Macro Assembler User's Guide

MCS-51 Macro Assembly Language Pocket Reference

ORDERING INFORMATION

Part Number	Description
MCI-51-SDK	MCS-51 System Design Kit